THURSDAY, FEBRUARY 6, 1872

ENTOMOLOGY IN AMERICA

First Annual Report of the United States' Entomological Commission. (Washington: Government Printing Office, 1878.)

WE have received the first annual report of the United States Entomological Commission for the year 1877, "relating to the Rocky Mountain locust, and the best means of preventing its injuries and of guarding against its invasions." The title-page bears the heading, "Department of the Interior, United States Geological Survey, F. V. Hayden, U.S. Geologist in charge;" but the report is by C. V. Riley, A. S. Packard, Jun., and Cyrus Thomas, and it simply passes, *pro formâ*, through Dr. Hayden's hands to the Secretary of the Interior. The amount of entomological work previously done by the Survey is well known.[1] Before speaking of this report it may be well to refer to the circumstances which have led to its being made. During the years 1873-76 the injury done by the Rocky Mountain locust in states west of the Mississippi was so great as to create a feeling that steps should be taken by Congress towards mitigating the evil. A conference of the governors of various western states and territories was held at Omaha (Nebraska) in October, 1876, the result of which was a memorial to Congress for an appropriation of 25,000 dols. and the creation of a commission of five experts to thoroughly investigate the subject. Congress acceded partially to this and an act was passed "appropriating 18,000 dols. to pay the expenses of three skilled entomologists to be attached to Dr. F. V. Hayden's United States Geological and Geographical Survey of the Territories," and the Secretary of the Interior appointed the gentlemen above-named. As soon as the commissioners were appointed they met at Washington and agreed upon the division of labour. Their scheme was laid before the Minister of the Interior on March 22, 1877, was approved, and was immediately put in operation. Within eleven months from that date the report was prepared and ready for presentation. When it is considered how vast was the district to be examined, how numerous were the records of the movements of locusts during the year that were collected, and what a range of subjects the report includes, it seems astonishing that so much should have been accomplished in the time. The locust-area was divided into three districts for convenience. Mr. C. V. Riley took the region east of the Rocky Mountains and south of the 40° N., the western half of Iowa, and conjointly with Mr. Packard, British America west of 94° W. Mr. A. S. Packard took Western Wyoming, Montana, Utah, Idaho, and the Pacific coast. Mr. Cyrus Thomas took the portion north of Mr. Riley's region, including the eastern half of Wyoming, Northern Colorado, the southern and eastern part of Dakota, Nebraska, the eastern half of Iowa and Minnesota. Circulars asking for information were distributed among farmers and others, and every assistance seems to have been offered by the officials of the different states, of the Post Office, and of the railways. On the subject of the movements of locusts as many as 2,500 observations were thus obtained for the year.

The report is divided into nineteen chapters, and the scope of the work will be most conveniently indicated by giving a brief *résumé* of each.

Chapter I. is devoted to classification and nomenclature. It is pointed out that the words "locust" and "grasshopper" are often very loosely used, including diverse insects belonging even to different orders. The limitation of the use of the word "locust" in the report is explained at p. 33. "This family [speaking of the *Acrididæ*] contains the true locusts, such as those of Oriental countries and the Rocky Mountain locust; also such so-called grasshoppers as the common red-legged species of the States and those found hopping on the ground in open waste fields, along roadsides, &c. Therefore, in speaking hereafter of these species, we shall use the term *locust*." So that, insects belonging to the family *Locustidæ*, are not here included under the general term locust. The family *Acrididæ* is divided into three sub-families, the *Proscopinæ*, the *Acridinæ*, and the *Tattiginæ*. The first is an exotic family, and dismissed from further consideration. The *Tattiginæ* are comparatively few, quite small, and seldom noticed by unscientific observers. It is, therefore, only with the *Acridinæ*, which includes all the migratory locusts, that the classification deals. This sub-family contains several subordinate groups; but of these the writers remark, "no arrangement we have seen can be considered satisfactory." Reasons are given for excluding from consideration all genera except *Acridium* and *Caloptenus*. *Acridium* is limited in its permanent region to districts south of the latitude of St. Louis. *Caloptenus* has a wider region, and causes far greater losses by its ravages. After discussing Stål's *Calliptenus* the writers describe *Caloptenus* as they understand it (p. 40). There are twenty-nine species recognised in the United States, but of these there are but three which, for the purposes of the work, have to be considered, "as they are the only ones generally distributed, which are so closely allied to each other as to render it difficult to distinguish them." These are the *C. spretus*, Thomas, *C. atlanis*, Riley, *C. femur-rubrum*, De G. Three plates are devoted to illustrating the details of their appearance in different stages of growth. Throughout the report they are spoken of by their popular names: *atlanis* is called the lesser locust; *femur-rubrum*, the common red-legged locust; and from among the many names for *spretus*, such as "the hopper," "the army grasshopper," "hateful grasshopper," "Rocky Mountain locust," &c., the commission have adopted the last. It is with this Rocky Mountain locust and its depredations the report is mainly concerned, though the damages by others are not excluded.

Chapter II. (pp. 53 to 114) gives a chronological history of the ravages in past years, beginning with the imperfect records of as far back as 1818, and this is summarised in a tabular form (p. 113). With regard to this history it is pointed out that while the later years are recorded as years of wide-spread emigrations, it must be remembered that our means of obtaining statistics have improved. "There are no facts tending to show that the locusts themselves have been any more numerous of late years than previous to, for example, the years 1866-1867."

[1] See especially 4th, 5th, 6th, and 9th reports.

Chapter III. gives "Statistics of Losses." The estimate of losses is made by taking a "locust year" for comparison with one when there was no locust visitation. Dr. Hayden in his letter to the Secretary of the Interior, which accompanied the Report, has thus summarised it. The great practical importance of an exhaustive study of this destructive insect throughout all the immense extent of the locust area, which lies between the 94th and 120th meridian, embracing nearly two million square miles, may be realised from the fact that on a careful estimate from all the data obtainable, the States and territories lying west of the Mississippi and east of the great plains, suffered by the depredations of the locusts an aggregate loss in destruction of crops alone during the years 1874-77 of 100,000,000 dols., to say nothing of the indirect loss by stoppage of business and various enterprises which must have been as much more, thus making the direct and indirect losses at not less than 200,000,000 dols.

Chapter IV. (pp. 123 to 131) is occupied with considering the agricultural bearing of the locust problem, points out what crops suffer most, and discusses what is likely to be the effect of agricultural operations in the future. Such precautions as accurately knowing the dates of invading swarms and planting early or late accordingly are referred to.

Chapters V., VI., VII. (pp. 131 to 212) are occupied respectively with an account of observations on the "permanent breeding grounds," the "geographical distribution," and the "migrations" of the Rocky Mountain locust. Previous to 1877 very little was known of the breeding grounds. The Commission has been able to map the area and also map the districts subject to invasion, while the directions taken by invading and returning "armies" are also given. It is found that, as a rule, flight is undertaken only during a part of the day and in fair, clear weather, so that the desire for food, cloudy or rainy weather, and adverse winds, may keep them from rising and taking wing. In all flights it seems the locusts rely much on the wind to carry them, usually turning their heads towards the wind and drifting backwards. When the wind is slight, however, they use their wings and turn their heads forwards. Their flights can be continued for several days over a distance of several hundred miles. The rate at which they travel is variously estimated at from three to fifteen or twenty miles an hour, determined by the velocity of the wind. There are facts which show that they can fly two miles and a half above the general surface of Kansas and Nebraska, and far out of sight of the keenest vision. This will explain their often sudden and mysterious appearance in areas without anything having been seen of them on the line along which they travelled. Sometimes two swarms have been seen moving in opposite directions, one in an upper and one in a lower current. With regard to the return migrations, the Commissioners remark that they are led to the conclusion "that by some law governing them there is a tendency in the resulting broods hatched in this visited area to return to the native habitats from which their progenitors came." The connection of meteorological phenomena with migration is entered into at considerable length, and many pages of meteorological data are given.

Chapter VIII. (pp. 212 to 257) is devoted to habits and natural history. Various observations are collected as to the quantities of eggs laid and the conditions of hatching. The laying season is from six to eight weeks; the average interval of laying is two weeks, and the average number of egg-masses is three. The idea that locusts are led by kings or queens is unfounded. The reasons assigned for migrations are (1) hunger, (2) the desire to find fresh breeding-grounds, (3) to escape natural enemies, (4) "instinctive impulse." Though by choice their food is the various cereals, they will eat almost anything at a push, even "dry leaves, paper, cotton and woollen fabrics. . . . They do not even refuse dead animals, and have been seen feeding on dead bats and birds." They often strip fruit trees of their leaves. "Forest and shade trees suffer in different degrees, and some, when young, are not unfrequently killed outright." At the end of this chapter reference is made to unnecessary alarm often caused by comparatively harmless locusts.

Chapter IX. is on "Anatomy and Embryology," and this, according to a statement in the introduction, is by Mr. Packard. Two diagrammatic drawings and several figures illustrate this part of the work; and Mr. C. S. Minot has contributed a few pages on the "fine anatomy," illustrated by plates.

Chapter X. is on "Metamorphoses." The Rocky Mountain locust requires about seven weeks from hatching to attain full growth, and during that time it passes through six stages. Plate 1 illustrates these. Though in European migratory species there is a difference of opinion as to whether there are four or five moults, the writers say they have "thousands of mounted and alcoholic specimens of all ages" showing the six stages. "The number of moults may vary according to the amount of nutrition and rapidity of development."

In Chapter XI. on "Invertebrate Enemies," the life-histories of many insects are given, and this part of the work occupies fifty pages.

Chapter XII., on "Vertebrate Enemies," gives a *résumé* of what is known of the usefulness of birds. Blackbirds, prairie-hens, and quail, are found to be good locust destroyers, while a special section is given to stating reasons why the English sparrow should not be introduced.

Chapter XIII., seventy pages in length, is largely of interest to mechanicians, and deals with "remedies and devices for destruction." Many of the remedies are agricultural operations to be performed at particular times, according to varying circumstances, but the special devices, both protective and for "catching or bagging" eggs and insects are numerous and are illustrated by woodcuts. The three succeeding Chapters are on "influence of prairie fires on locust increase," "influence of weather on the species," "Effects that generally follow severe locust injury." Then follows a Chapter (XVII.) on the uses to which locusts can be put, in which it is urged they form an abundant and nutritious article of food. "Why should the people of the West, when rendered destitute and foodless by these insects, not make the best of the circumstances, and guard against famine by utilising them as food?"

The different methods of cooking locusts are entered into, and an account is also given of the use of them by different nations. They were counted as clean animals

by the Jews [Levit. xi. 22], and Herodotus mentions a tribe of Ethiopians which fed on locusts, which came in swarms from the southern and unknown districts.

Mr. Riley speaks of good broth being made "by boiling the unfledged *Caloptení* for two hours in a proper quantity of water, and seasoned with nothing but pepper and salt; the broth is hardly to be distinguished from beef broth." Boiled, fried, or roasted the full-grown are said to make pleasant food, and ground and compressed they will keep a long time. The other uses suggested are as fish bait, as manure, and as a source of formic acid.

There are altogether twenty-seven appendices occupying 279 pages, the last appendix giving the bibliography of the subject.

GUTHRIE'S PHYSICS

Practical Physics, Molecular Physics, and Sound. By Frederick Guthrie, Ph.D., F.R.SS. L. and E., Professor of Physics in the Royal School of Mines, London. (London: Longmans, Green, and Co., 1878.) [London Science Class-Books, edited by G. Carey Foster, F.R.S., and Philip Magnus, B.Sc., B.A.]

"THE works comprised in this series," the editors tell us, "will all be composed with special reference to their use in school-teaching; *but*, at the same time, particular attention will be given to making the information contained in them trustworthy and accurate, and to presenting it in such a way that it may serve as a basis for more advanced study."

The little word *but*, which we have taken the liberty to emphasise, seems to hint at some opposition between accurate statements and school-teaching, which, if not a fundamental necessity, is at least a universally existing phenomenon in the present order of things. This series of class-books is by no means the first attempt to procure books for children from writers of scientific reputation; and Prof. Guthrie, the author of this little book on practical physics, has himself invented several experimental methods at once interesting, ingenious, and simple.

If a child has any latent capacity for the study of nature, a visit to a real man of science at work in his laboratory may be the turning-point of his life. He may not understand a word of what the man of science says to explain his operations, but he sees the operations themselves, and the pains and patience which are bestowed on them; and when they fail he sees how the man of science, instead of getting angry, searches for the cause of the failure among the conditions of the operation.

Accordingly, in this little book the parts which are most interesting, whether to young or old, are those in which Prof. Guthrie describes his own beautiful experiments on the size of drops and bubbles, or teaches us how to blow glass. But if he once opens his ears to the siren song of the scientific imagination, floating down from heights unprofaned by experiment, through the window of the laboratory, and makes three paces through the room from the blowpipe to the lecture-table, we know that the curse has come upon him, and that for him it will never more be possible to reconcile the claims of accuracy with those of school-teaching.

What but some vile enchantment could have induced an intelligent man to begin his discourse to the poor little children in this style:—

"§ 1. **Hardness. Form-elasticity.**—The pressure required to alter the relative positions of two contiguous parts of a body measures its hardness. As this pressure is greater with greater surface of contact, some unit of surface must be fixed upon. The term hardness is generally applied loosely to difficulty of fracture. The following remarks may show that our speech and ideas in regard to hardness are deficient in precision. Glass is said to be harder than lead, yet a glass cup is more easily broken than a leaden one—more easily broken, though not so easily bent. Hard bodies are always elastic; elastic bodies are not necessarily hard, nor are they necessarily brittle, nor are soft bodies necessarily plastic. Toughness seems to imply a resistance to change of form, which resistance increases more rapidly than the displacement; thus, while a band of vulcanised caoutchouc will be extended to a degree proportional to the weight hung at one end, a leathern strap will not be extended twice as far if the weight on it is doubled. Toughness is generally associated with texture, and stretching causes partial fibration in the line of pull."

Here is a teacher who, with all the stores of science to choose from, selects, as the first lesson to a child, the necessity of fixing on a unit of surface, which, however, he makes no attempt to do, but goes on to harangue him on the deficiency in precision of our ideas and language in regard to hardness.

The poor child is not responsible for this want of precision; his first duty is not to reform his language, or even to criticise it, but to learn it, and if there is any part of human knowledge about which our speech and ideas have become tolerably precise, let us teach him that first, so that he may have some hope that knowledge is attainable before we let him see, as we must at last, how confused our own notions are.

Whether a child receives any special instruction in science or not, it is of unspeakable advantage to him if he is not put in the way of explaining things by false hypotheses. The difficulty which we have in recognising the paradoxical character of some of the most celebrated paradoxes shows how much has been done by the teachers of the last two centuries in causing false principles to be forgotten. The paradoxes are no longer paradoxical, because the dogmas which made them so are now known only to the owls and the bats.

We have selected a few statements in this book which we do not remember to have seen before.

(When a wire is stretched by a weight) "it may be assumed that the volume of the metal remains approximately unchanged, so that if the elongation is such that the length m becomes n, the original diameter d becomes $d\sqrt{\frac{m}{n}}$" (p. 4).

"A drop of water on a board strewed with powdered resin is nearly spherical." "The spherical is the form in which the mean distance of all parts from the centre of mass is the least. It is the most compact form for a given mass. This shows that cohesion moulds the drop to the spherical form" (p. 8).

Does Prof. Guthrie take his science from Rogers' verses on a tear? We refer him to Shakespeare ("King John," Act iii. Sc. 4) as a better authority on Capillary Attraction:—